

MOMENTUM



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MOMENTUM

Momentum serves to reward intellectual creativity by providing a forum to share students' scholarly perspectives and advance their academic potential.

Our Mission

Momentum advocates the presence of a diverse student population conducting independent studies. It serves as a platform that promotes creative inquiry and intellectual critique among undergraduates from all disciplines. Led by an Editorial Advisory Board, the biannual journal conforms to the highest levels of academic **honor** by utilizing a blind review process, which permits erudite submissions from undergraduates across all disciplines. The journal's ultimate goal is to publish works of scholarly research among a wide range of captivating themes. *Momentum* accepts works of independent studies, critical reviews, holistic perspectives, quantitative and qualitative research and creative inquiries from undergraduates in the Columbus State University community.

Letter from the Provost



Undergraduate research allows students to pursue their interests beyond what is taught in the classroom. Students at Columbus State University are encouraged to seek answers to the questions that interest them most. Regardless of their discipline, students' faculty-mentored research projects and creative activities are a vital part of a CSU education.

Momentum, Columbus State's newly-created undergraduate research journal, will demonstrate the quality and diversity of these projects. We are optimistic that this journal will become a highly visible element of the research culture at CSU. The papers published in this journal will represent the very best of the research and creative projects that have been conducted over the previous year. Through a rigorous evaluation process, the papers that are submitted each year are reviewed until only the best remain. The papers selected for this first publication of *Momentum* are excellent examples of undergraduate research at its finest.

We hope that this volume of *Momentum* will inspire its readers to participate in the research process. The important tools of research—maintaining a curious and open mind, never being satisfied with easy answers, accepting failures as challenges, and passionately moving forward—are important elements of success in any field. Columbus State's undergraduates are using these tools every day to prepare themselves for future excellence, and we are proud to present the work of a few of them here.

A handwritten signature in black ink, reading "Tom Hackett". The signature is fluid and cursive, with the first name "Tom" and last name "Hackett" clearly distinguishable.

Dr. Tom Hackett
Interim Provost and Vice President for Academic Affairs



COLUMBUS STATE
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National Undergraduate Research Experiences

Plant Genomics at Michigan State University's Hu Lab

by Khaliyah Abikoye



I had the absolute pleasure of doing research in the Hu Lab this summer and I can honestly say that I enjoyed every moment of it. My original expectations of the program were truthfully pretty low. I always knew that I wanted to work in the field of science. I just had a great deal of trouble picking which area of science. In 2010, I decided that I was interested in working with plant genomics so I can become familiar with the field. Having contacted Dr. Hu in 2008 to express my interests in the program, I wanted to build up my research skills in order to be better qualified for the program than other applicants. I did this by working with various professors at my home institution and exploring different types of research. I believe that this helped me a great deal in becoming prepared for the program.

The Peroxisome 2010 research project involves identifying proteins within peroxisomes from three different growth stages in *Arabidopsis Thaliana*. These proteins were confirmed to be peroxisomal and eventually we confirmed their peroxisomal localization. My job was to work on different lines and identify T-DNA insertion mutants for these lines. I also completed phenotypic assays of several mutants and my goal was to identify a defect in a gene that would display a phenotype. This particular phenotype would allow us to understand the function of peroxisomes and their relation to the B-oxidation pathway. The ultimate goal of this project is to understand more of the functions of peroxisomes, and their role in *A. thaliana*. It was a bit difficult at first to immediately grasp the research plan, since I did not have much lab experience. However, I was very eager to learn and to do a good job.

My favorite part of the program was being able to work with my mentor Gaelle Cassin. I felt really intimidated and awkward being in a new setting around machines that I did not know how to use, and she taught me a great deal. My first experiment in the lab was to extract genomic DNA from *A. thaliana*. Just hearing that made me nervous but Gaelle was able to guide me through the protocol and introduce me to the different types of machines in the lab that would allow me to accomplish that particular experiment. Over the next couple of weeks, I was able to work alone and ask for help from Gaelle if needed. I enjoyed the fact that I was trusted and able to complete certain experiments successfully. I performed several PCRs and completed phenotypic assays to complete my research. Without Gaelle's help and any of the other postdocs in the lab, I do not believe that I would have been able to come out as successfully as I did.

Being a part of Plant Genomics 2010 opened my eyes to different careers and has allowed me to have the advantage over some of my peers who do not have similar research experience. I am very grateful that I was chosen to work in the Hu Lab and I feel that it will benefit me in the future. I would like to continue researching plant peroxisomes and possibly learn more about their functions. I would also like to thank Michigan State University and the National Science Foundation for giving me a chance and advancing my career.

Studying Comparative Economics and Transformation of American Politics at Georgetown University, Washington, D.C.

by Jodian Jenkins

In the summer of 2010, I had the opportunity to live, learn and intern in the country's capitol. I lived on Georgetown University campus, and was enrolled in two political science classes: Comparative Economics and Transformation of American Politics. I did my internship with the Children's Right Council. This experience gave me the opportunity, apart from my internship, to visit and meet important places and people.



Georgetown University is a very unique school. Many important leaders who are alumni, eighteen in total, currently work in the United State Congress.

Part of my learning experience included briefings at different government sites in Washington, D.C. I attended a briefing in the House of Representatives by Congressman Andrea Smith from Nebraska. He spoke briefly of his experience on becoming a congress member, his role as a congressman, and his personal opinion on healthcare. I also had the opportunity to visit the World Bank and the Federal Reserve. At the World Bank, we were briefed on the role of the bank in helping the international community. The bank works as a lender and a sponsor: it lends money to countries, such as China and Japan. Since the bank acts as a sponsor it does not demand money back from countries that experienced natural disasters. One recent example would be in the case of the earthquake that killed thousands of Haitians and leaving thousands more homeless in Haiti. At the Federal Reserve the speaker briefed on the when the Federal Reserve started and its main role in lending money to banks.

The internship part of my experience allowed me the opportunity to work at the Children's Rights Council Headquarters in their legal department. The Children's Rights Council is a nationwide nonprofit organization which was founded in 1985. There are several councils located in all 50 states, where single and two parent families can obtain information on how to petition the court for child support, custody, or report child abuse cases. The organization works to be a voice for children, and to ensure their safety. During my internship I researched court procedures. As a part of my research, I sat in court hearings at the District Court of Columbia, where I did my observation on how the real court procedures are handled. Observing what the judges are asking of either the plaintiffs or of the defendants in custody, and child support cases. I researched how families can represent themselves (pro se) if they cannot afford a lawyer, and what they need know when representing themselves.

A part of this summer experience included giving back to the community. I did what was called "Service Saturday" with the Funds for America Studies organization. My service hours entailed volunteering at the Washington Hospice. There I was able to clean the hall ways, furniture and so forth. In doing so I had the opportunity to visit with the residents, telling them about my country and what I was doing in Washington D.C. They were rather informative, telling me about their families and their life's journeys. Many of the residents I spoke with were retired government workers. As an International student, the opportunities enhanced my experience in this country. I learned to appreciate my unique opportunities, met leaders who decide the law of this country and create lasting friendships. I was honored to be one of the few to have had this opportunity. I would recommend the Live Learn and Intern program to any international or domestic student.

Beyond the Score: Using Alternative Sources in an Examination of Historical Performance Practice

Emily Vold, Schwob School of Music

ABSTRACT

Despite being composed nearly 300 years ago, the *Sonatas and Partitas for Violin without Bass accompaniment* by Johann Sebastian Bach (1685-1750) remain some of the most technically and stylistically challenging repertoire studied and performed by violinists today, in part because no record from the composer, apart from the manuscript score, exists detailing how to perform the works. One specific technical challenge is the execution of three and four-note chords in precise rhythmic accordance with Bach's notation. In this essay, an analysis of musical conventions in the era referred to as the Baroque (1600-1750) shows that notation need not be followed strictly. Additionally, an examination of the violin and bow as developed by the 18th century, treatises on musical performance, and the scores of the *Sonatas and Partitas* themselves reveal how Bach may have intended performers to execute these chords.

INTRODUCTION

Interpreting and expressing the musical intentions of a composer in an informed manner requires great dedication and study on the part of a performer. This holds particularly true in the case of music written well before the present age, where direct connections to the thoughts of the composer and even the styles of the era have faded with the passing of time. Violinists today consistently struggle with studying and performing a set of works from the musical period *Bass accompaniment*, composed by Johann Sebastian Bach (1685-1750). These six works pose significant technical challenges in the form of

sustained three and four note chords. Violinists and scholars have long debated the proper stylistic performance of these chords; a truly informed interpretation requires careful study not only of the instrument used during the 17th and 18th centuries, but also of scholarly writings from the time, and analysis of the works themselves.

Prior to about the year 1600, vocal music was the highest regarded and most often composed of all musical literature. During the era referred to as the Renaissance (1400-1600), numerous composers wrote for instruments, but in general intended the instruments to accompany the voice, harmonizing or providing a countermelody to a madrigal. Furthermore, these composers often left the instrumentation – with the exception of keyboard accompaniments – open-ended, placing the sonority choice in the hands of the performer or allowing flexibility based on what instruments and musicians might be available. However, by about 1600, instrumental music began to gain prominence, in part resulting from innovations by two composers whose lives spanned a period during which musical styles changed significantly. In his operas, Claudio Monteverdi (1567-1643) assigned parts to specific instruments in the score, additionally expanding their importance in the musical texture (Burkholder 316). Giovanni Gabrieli (1554-1612) wrote many compositions for *cori spezzati*, or divided choirs, in which multiple groups of voices alternate singing sections of a piece. Noting its success with vocal ensembles, he applied the principle to works written solely for choirs of instruments (283). Out

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FACULTY MENTOR

Dr. Andrée Martin, Schwob School of Music

of such innovations came the composition of musical forms solely featuring non-vocal instruments: keyboard instruments, such as the harpsichord and organ, certain wind instruments, notably the transverse flute and the bassoon, and the string family, including the lute, viola da gamba, cello, and perhaps most extensively, the violin (Boyden 98).

The violin is one of the most versatile instruments, due to its large pitch range, variety of articulations, range of tone colors and dynamics, and ability to sustain its sound. Beginning in the 17th century, composers realized the full potential of the instrument, and as a result, music surfaced that challenged players to stretch their technical abilities (99). Italian violinist-composers such as Archangelo Corelli (1653-1713) and Antonio Vivaldi (1678-1741) were influential in this respect, expanding the range of the violin to new heights and introducing double and multiple stops – two or more notes written to be played simultaneously – into their compositions. Furthermore and particularly in the case of Vivaldi, virtuosic passages with quick arpeggiations, fast scalar runs, and the use of new bow techniques, permeated these works (284).

Throughout the Baroque era, a body of violin solo and chamber music repertoire blossomed as composers across Europe embraced the melodic possibilities of the instrument. From concertos, concerti grossi, and trio sonatas in Italy to dance suites in France, and even a number of unaccompanied works in Germany, the violin was well represented in each major musical country. While performing technique and compositional styles generally remained nationalized throughout the 17th and 18th centuries, composers were to some degree influenced by musical information traveling between different countries (284). As in the case of a certain German composer, Johann Sebastian Bach, assimilating the compositional ideals of his native country with those from France and Italy defined the entire body of his work, including his many works for the violin.

Bach, while as a performer best remembered for his skills at the organ and harpsichord, was an

accomplished and successful violinist. His father, Johann Ambrosius, who worked as the director of the music company in Johann Sebastian's hometown of Eisenach, Germany, played the violin as his primary instrument, and likely taught the younger Bach how to play (Wolff 23, 42). As a student at St. Michael's School in Lüneberg, J.S. Bach's musical studies focused primarily on vocal performance, and later, keyboard lessons (59). However, in his ensuing professional career, he held positions on several occasions requiring him to perform extensively on the violin.

In his first position following graduation, Bach briefly worked as a violinist in the court at Weimar in 1703 (Lester 9). He would return there five years later, hired as the court organist as well as chamber musician (Wolff 148). In 1714, he received a promotion to concertmaster, in which Bach led the court orchestra seated in and performing from the first violin chair (148). For him to have earned this placement suggests that his violin technique was well developed. One of his sons, Carl Philipp Emanuel (1714-1788), in a letter to the earliest Bach biographer, Johann Nikolaus Forkel, notes "in his youth, and until the approach of old age, [Bach] played the violin cleanly and penetratingly..." (Bach 397). Following a change of employment in 1717, Bach did not actively perform on the violin; however, Carl Philippe Emanuel, in this anecdote, suggests that his father continued to study and play the instrument at home (397). His deep knowledge of the violin and its technical abilities coupled with his compositional prowess reflects itself in all his works for the instrument.

Following the concertmaster post in Weimar, Bach and his family moved to the town of Cöthen, where he took up the position of Kapellmeister, or music director, for the Prince of Anhalt-Cöthen (Wolff 187). There he composed the *Sonatas and Partitas for Violin without Bass accompaniment* no later than 1720, according to the date on one extant original autograph manuscript (Vogt 17). Musicologist Malcolm Boyd speculates that Bach had a performer in mind while composing these six works, offering the names of violinists Joseph Speiss, Johann Georg Pisendel, and Jean Baptiste

Volumier (Boyd 95). Alternatively, other scholars, such as Hans Vogt, suggest that Bach did not anticipate the public performance of these works, but instead intended them to be technical studies (Vogt 167).

Regardless of his intent, violinists over hundreds of years have included these works in their standard repertoire; today, their study and performance has reached ubiquity. Even in the generation following Bach's death in 1750, a period in which Bach's music was considered old-fashioned, musicians affirmed the worth of the Sonatas and Partitas in particular. Carl Philippe Emanuel, again in his correspondence with Forkel, notes "one of the greatest violinists told me once that he had seen nothing more perfect for learning to be a good violinist, and could suggest nothing better to anyone eager to learn, than the said violin solos without bass" (Bach 397). Likewise Forkel, in his 1812 biography of Bach, affirms this sentiment writing, "for a long series of years, the violin solos were universally considered by the greatest performers on the violin as the best means to make an ambitious student a perfect master of his instrument" (Forkel 472). The technical and musical challenges presented by these works to violinists in the 18th century fully remain even today despite a significant increase in general technical abilities.

As the title suggests, the *Sonatas and Partitas for Violin without Bass accompaniment* lack a part for the basso continuo – the joint union of a keyboard instrument and single-voiced bass instrument – which would normally provide harmonic elaboration. Unaccompanied works for the violin appeared prior to Bach's collection, notably by his German predecessors – composers such as Heinrich Biber (1644-1704) and Johann Paul von Westhoff (1656-1705); however, the bulk of Baroque sonatas for typically monophonic – single voice – instruments had at least some form of keyboard accompaniment, and usually a complete continuo part (Boyd 95). The universality of the basso continuo in the Baroque era is revealed by the fact that Bach took care to include on the front page of his manuscript as well as in the titles of each individual sonata or partita the qualifier

"without bass" (Lester 11). In these works, Bach uses variations in the instrument's range as well as the presence of four unique strings to provide a harmonic context on an instrument that usually plays one solo line, doing so in two contrasting manners.

Scholars refer to the first compositional technique as linear counterpoint, in which Bach composes a solely monophonic line throughout an entire movement or section of a movement. To provide the harmonic context, some or all of the notes of each chord in a progression are outlined, sometimes through simple arpeggiation but at other times integrated with other non-harmonic tones. He then uses wide interval contrasts between pitches and differences in timbre between the violin's four strings to create the aural perception of multiple voice polyphony, most commonly the sense of a bass line separated from melodic figurations (Kurth 76-77).

However, in other movements of the works, Bach requires the violinist to perform multiple notes simultaneously in order to either fill out harmonies or create the sensation of polyphony. While most double-stops can be negotiated without much difficulty aside from achieving accurate intonation, triple and quadruple stops, particularly many that appear in the Sonatas, pose a greater challenge to performers. Not only does Bach occasionally require tricky left hand fingerings, engaging all or even three of the violin's strings simultaneously with a pleasing tone quality remains a significant challenge to the modern performer. Furthermore, when assessing a literal reading of Bach's scores, one discovers numerous instances in which he writes that all notes of a three or four note chord should be sustained for equal durations, and moreover for lengths of time requiring an extended continuance of the sound (Lester 47).

Such challenges result in a range of opinions regarding the performance of three and four note chords in Bach's violin music: performers must consider how long to sustain individual notes within the chord, whether or not all notes of the chord will be attempted simultaneously – and if

not, then how much breaking of the chord will occur – and the desired tone quality and dynamic level of the chord. Additionally, in the three fugue movements, violinists must be concerned with emphasizing the fugue theme throughout in spite of triple and quadruple stops seemingly interrupting the melodic figure. Some performers will base their musical judgments on what best suits modern technique and the modern instrument; however, others wish to adhere to historical performance practice as much as possible whether performing on a modern or a period violin.

Unfortunately, no record exists of how Bach himself would have performed or encouraged others to perform the *Sonatas and Partitas*, much less the chords within. Furthermore, no definitive record of their performance or the practice thereof from the 18th century exists. However, alternative sources provide significant insights from which conclusions about performance may be drawn. Considering the structure of the violin and bow used in the early 18th century functionally reveals some technical possibilities and limitations. Additionally, treatises on musical performance written by scholars living in the generation following Bach's death, while not specifically referencing the *Sonatas and Partitas*, describe standard execution of violin technique in the 1700s. These sources, when coupled with a thorough study of the manuscript scores, enlighten performers interested in presenting a historically informed performance of the works.

The violin in use during Bach's life closely resembles those used today in shape and measurement; however, performers should consider two key differences in its fittings when emulating the performance style and sound quality likely produced in the early 18th century. First, violin bridges before about the 19th century curved slightly flatter than bridges constructed thereafter. As a result, less arm motion was necessary for the execution of string crossings, and it was easier to play two or three strings simultaneously (Boyden 320). However, in spite of the flatter bridge, there is no evidence that violinists were expected to perform full quadruple stops – four strings –

simultaneously; Jean-Jacques Rousseau, a 18th century music theorist in addition to philosopher, notes this in his *Dictionnaire* (Donington 93). Second, the four strings were generally wound from animal gut, with the possible exception of the lowest string – the G-string – that, according to music theorist Sébastien de Brossard in his 1712 treatise, was frequently entirely wound with silver. This resulted in a slower sound response as well as more subdued volume than is possible with the metal wound strings used today (Boyden 321).

Compared with the slight modifications made to the violin between the early 18th century and the present, bows constructed before 1750 are significantly different from those used today. While craftsmen did not appear to implement any standards regarding the length, weight, or exact shape of their bows even until the 1800's, in general, bows dating from the Baroque era period tend to be several inches shorter than today's bow, which allows the horsehair to stretch about twenty-five inches in length (Boyden 207). The bow stick almost invariably curves outward away from the hair, unlike the modern model, which curves slightly into the hair. German bows in particular held onto this characteristic the furthest into the early 18th century, and also featured the most definite curvature as compared to those used in France and Italy. Violinists, as a result, could execute simultaneously timed triple stops – although again, most likely not quadruple stops – in a more facile manner than can be done with today's bow. As these bows are lighter than the modern bow, the sound they produce from the violin is more transparent; additionally, because the bulk of the weight of the bow is balanced toward the frog, the volume of sound naturally decays, even on sustained notes, particularly when drawing the bow from the frog to the tip (326).

During the early 20th century, scholars, seeking to rectify what they viewed as a discrepancy between the duration of chords in Bach's works and what

could be feasibly performed on the instrument, assumed that a different bow altogether than the one described above – a bow with the capabilities to sustain even quadruple stops – must have

existed in Bach's time. Scholar Arnold Schering was the first to promulgate the theory of a "Bach bow" in 1904, describing a bow in which the thumb would control the tension of the horsehair, tightening it for melodic, monophonic passages, and relaxing it for chords. Scholar Albert Schweitzer accepted Schering's theory, and explained and defended it in his 1905 biography of Bach. This widely read book led a variety of violinists and bow makers over the next half-century or so to experiment with recreating the "Bach bow" (Kolneder 314). This resulted in models in which the stick hooked more steeply convex than in any extant Baroque bows with a frog containing a ring in which the thumb would rest so that it could control the tension of the hair. However, while the problem of sustaining triple and quadruple stops appeared to be resolved, one fundamental issue remained: the sound produced was relatively weak, seemingly out of character with, for example, the musical spirit of Bach's fugal or dance suite movements (315).

The simple fact that no similar bow dating from the 17th or 18th centuries has survived despite the existence of many other bows from that period suggests that Schering and Schweitzer's theory is erroneous. Further compounding the evidence against the "Bach bow," none of the treatises or articles from the time period known as the Baroque era or the years following it mentions such a bow, nor do any illustrations of it remain (315). Clearly, the answer to the problem of Bach's chords is more complex than simply a difference of equipment. Fortunately, the same treatises that fail to mention the "Bach bow" do instruct in violin technique and usually address the execution of multiple stops.

While in the 17th and 18th centuries a greater degree of musical knowledge traveled across country borders than previously, some national

differences in instrumental technique remained; therefore, it is best to begin by examining the writings of musicians from Bach's native Germany. Flautist and composer Johann Joachim Quantz (1697-1773) in 1753 published the treatise *On Playing the Flute*, which, despite its title, covers not

only flute technique but also teachings on musical notation, form, how best to practice and perform, a discussion of orchestral string playing, as well as commentary on a few German composers, Bach included. Having seen him perform at the organ several times, Quantz discusses Bach's keyboard technique; however, he says very little about his compositional style and does not refer to any works written for other instruments (Quantz xx). In his general recommendations to violinists, Quantz notes the proper technique for playing chords, stating that the lowest notes must be played quickly, without sustain regardless of the tempo of the work. In chords not followed by rests, the top note will remain sustained the full duration of the rhythm. Quantz states the effect of breaking a four-note chord will sound as "a chord arpeggiated in triplets" (227). One must consider, however, that Quantz specifically targeted these instructions at ripieno – orchestral – violinists accompanying in a concerto grosso or concertate, so these recommendations may not apply to solo performance.

Leopold Mozart (1719-1787), a violinist, teacher, and most prominently, father to famed son Wolfgang Amadeus, in 1756 wrote *A Treatise on the Fundamental Principles of Violin Playing*. While not specifically referring to Bach, the treatise assists in understanding the level to which violin technique had developed around the same time as the *Sonatas and Partitas* were written. Mozart spends a great deal of time discussing the effect of multiple stopping on the need to change the position of the left hand; however, his words regarding their execution in the right arm are brief. Following the description of a triple stop, Mozart asserts that all three notes "must be taken together at the same time and in one stroke" (Mozart 160). Later in the treatise while discussing orchestral playing, he reaffirms this statement, describing his ideal chords as played "smartly and together" (224). Unfortunately, Mozart does not make mention of the proper sustain of chords, only their attack.

Other non-German musicians and scholars of the era had their own opinions regarding the performance of chords; while their school of string

technique might have differed slightly from that in which Bach's violinist acquaintances were trained, their ideas remain valid. Jean-Philippe Rameau (1683-1764) recommends that, where two or more notes cannot easily be performed together on the instrument, the notes should either be arpeggiated or that the violinist should give weight and sustain to whichever note forms part of the melodic line, regardless of its placement within the chord (Donington 93). Marin Mersenne (1588-1648), also French, admits in his treatise *Harmonie universelle* that the bridge would need to be even flatter than its typical curvature in order for more than two strings to be played simultaneously (Efrati 209). While regional differences regarding sound quality preference or advancements in violin technique may have affected the opinions of these two musicians, given the lack of explicit instruction from Bach himself, their suggestions should be considered when attempting a historically informed performance of the *Sonatas and Partitas*.

While Bach unfortunately left no writings behind regarding the performance of his unaccompanied violin works, the scores themselves can provide ample evidence of Bach's intentions. However, it is important to consider a difference in mindset between modern performers and those active during what is considered the Baroque era regarding musical notation; teachers often instruct today's musicians to play the music exactly as written on the page. While this approach is successful when applied to more recent compositions, applying it to works of other eras contains risks. In the words of music critic Alex Ross, before about the middle of the 19th century, performers viewed the scores "less like papal writs than like cooking recipes"; it provided guidelines that could be altered to the taste of the musician (Ross "Escaping the Museum").

This idea surfaces as early as in the writings of Bach's son C.P.E. In his *Essay on the True Art of Playing Keyboard Instruments*, he writes of holding notes "played neither detached, nor legato or sustained" for roughly half their written value (Efrati 202). Modern Baroque scholars such as Robert Donington consider Bach's notation a

representation of how the music will be heard by the ear. While the performer may not be physically able to execute fully the written sustain of the chords, the listener's brain is able to complete the polyphonic texture (Donington 92).

As further proof of the flexibility of notation, for much of what is today called Baroque era, specifically in France and Germany, composers expected performers to embellish significantly the notes composed on the score through the addition of ornamentation. While Bach preferred not to lend this degree of freedom to performers of his works, instead in effect writing out his desired ornaments, this sense of notational fluidity likely remained (Vogt 58). Additionally, after about 1600 it became standard practice among composers to provide in keyboard accompaniments solely a monophonic bass line and figures underneath detailing the desired harmonic structure, a system referred to as figured bass. Composers then expected keyboard players to fill out the chords, called realizing a figured bass, in a thicker accompaniment texture, and keyboard players would most likely improvise this even in performance (Burkholder 301). Bach, in his chamber music, used figured bass notation, lending freedom to the performer (451).

In the *Sonatas and Partitas*, numerous examples exist of what modern performers might consider a discrepancy between Bach's notation and what is feasible on the violin. However, analyzing Bach's music in a manner less concerned about notational precision and applying principles expressed by musicians of his time regarding technique or style aid in any examination of historical performance practice. In spite of the hundreds of years separating today's violinists from the composer, stylistic interpretation of Bach's music need not be an enigma; alternative sources provide keen insights for an informed performance.

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Toward a Better Story: A Paradigm for Positive Communication in *The Lord of the Rings*

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ABSTRACT

This paper examines a textual analysis of J.R.R. Tolkien's modern classic tale, *The Lord of the Rings*, for the purpose of uncovering a paradigm for positive interpersonal, intergenerational, and intercultural communication. The paper begins with a brief explanation of Walter Fisher's narrative paradigm, which contextualizes the relationship between positive communication and an epic narrative such as *The Lord of the Rings*. Following the description of Fisher's theory, a summary of analysis by Bowman (2006) on metanarrative aspects of *The Lord of the Rings* is presented as the foundation for the analysis offered in this paper. The remainder of the paper reveals a paradigm for understanding our own lives as stories constructed from these metanarrative aspects of *The Lord of the Rings*. Using this paradigm, a framework for positive interpersonal, intergenerational, and intercultural communication is presented, thus establishing the positive correlation between these aspects of communication and good stories.

INTRODUCTION

Open a book. Turn on the television or the radio. Have dinner with friends. No matter the context, one thing is bound to happen: a story will be told. Booming industries exist that thrive solely on the telling and hearing of stories. Stories are delivered audibly, textually, and visually. Stories are mailed to our houses, sent directly to our televisions, or downloaded to our computers or iPods. There is, of course, a good reason for all of this: we love stories.

Our love of hearing a good story is matched only by our love of telling stories. As Walter Fisher's narrative paradigm theory explains, people are story-telling creatures. The present paper will examine metanarrative¹ aspects of J.R.R. Tolkien's *The Lord of the Rings* in order to provide a framework for positive communication. Narrative theory will be used as a basis for uncovering these metanarrative themes. The themes provide a paradigm² for understanding our own stories in what Tolkien referred to as the Primary World.³

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¹ Metanarrative refers to story that reflects on the nature of story – a narrative about narrative.

² A paradigm is a conceptual framework for understanding. In this paper, we are considering the framework of *The Lord of the Rings* as it applies to narrative.

³ J.R.R. Tolkien referred to the world of the story-teller and hearers as the Primary World. The Secondary World is the world the hearer enters as he "believes" the story being told.

Finally, the paper will explain how this narrative paradigm of *The Lord of the Rings* offers a framework for positive interpersonal, inter-generational, and intercultural communication.

Initially, a fictional narrative may seem irrelevant to the development of positive communication. However, as Fisher's narrative paradigm explains, there is a strong relationship between communication and story. For this reason, Fisher's theory makes the connection needed for discussing a work such as *The Lord of the Rings* within a communication context. As a launching pad for the discussion of metanarrative themes in the story at hand, I will draw upon extant research by Mary Bowman and her discussion of metanarrative aspects of *The Lord of the Rings*. It seems fitting, then, to begin with a brief description of Fisher's narrative paradigm and the results of Bowman's analysis.

NARRATIVE PARADIGM

In 1984, Walter Fisher proposed the narrative paradigm as a way to better and more fully explain human communication, specifically the nature of rhetoric. Since the Enlightenment, the Western world has enjoyed a love affair with Aristotle's notion of logos, or reason. The notion of reason has led to what Fisher describes as the rational-world paradigm, which claims that people's decisions are made solely by logical means. Fisher, however, was opposed to the idea that people are persuaded only by facts and well-crafted arguments. Rather, he claimed, people make decisions based on *good reasons* which also leave room for mythos, or beliefs rooted symbolically in stories. The narrative paradigm accounts for this storied aspect of human nature.

Good reasons, as described by Fisher, are driven by two factors: coherence and fidelity. Narrative coherence is a matter internal to the story, and it is concerned with the story being true to itself so as not to come unraveled from within. In order for a story to cohere, the characters must act in a believable way, and the plot must be credible; that is, it must be possible within the story-world. Unlike coherence, narrative fidelity deals with external matters. A story must ring true for the

hearer and must demonstrate a faithfulness to life as the hearer experiences it. When a story shows coherence and fidelity, it is more likely to be accepted by and attractive to the hearer.

THE STORY WAS ALREADY WRITTEN⁴

As a tale treasured around the globe, *The Lord of the Rings* demonstrates the coherence and fidelity that Fisher's theory describes. *The Lord of the Rings* itself contains a significant amount of narrative theory. In her analysis of Tolkien's "trilogy,"⁵ Bowman (2006) states, "*The Lord of the Rings* goes beyond being an absorbing and moving story to constitute a meditation on the nature of story" (p. 273). She goes on to explore metanarrative aspects of *The Lord of the Rings*, including the characters' conversations, the structure of the novel, and the narrative technique of Tolkien, who she says has "invited us to reflect on the nature of the tale and our experience of reading it in much the way that narrative and reader-response theories do" (Bowman, 2006, p. 272).

"*The Lord of the Rings* encourages readers both to embrace the power of story and to think critically about the nature of that power and how it operates" (Bowman, 2006, p.289). The present paper aims to do just that. Bowman describes *The Lord of the Rings* as a meditation on the nature of story. The characters understand themselves to part of an ongoing story and often reflect on that understanding. I would like to go beyond Bowman's analysis to describe how *The Lord of the Rings* provides a paradigm of its own through which we may view our own stories. Stated more simply, Bowman is concerned with the *existence* of metanarrative in Tolkien's story; I am concerned with its meaning.

⁴ Mary R. Bowman's article on this subject is titled "The Story Was Already Written: Narrative Theory in *The Lord of the Rings*."

⁵ Tolkien wrote *The Lord of the Rings* as a single unified work, but the story was broken up and published in three separate pieces.

In addition to uncovering the meaning of the narrative paradigm within *The Lord of the Rings*, I will explain how that paradigm contributes to positive interpersonal, intergenerational, and intercultural communication. Positive communication is defined here as any interaction between two or more persons which produces understanding resulting in the betterment of all persons involved. In narrative terms, positive communication could be simply expressed as any such interaction resulting in a better story.

THE STORY OF OUR LIVES

Thus far, I have purposefully avoided an important narrative axiom. That is, we are more than storytellers and story-hearers; we are also story-livers. "We live our lives as stories," says author and scholar, John Rodden (2008, p.148). Narrative theorist Gary Morson (2003) describes the world we live in as a "world of eventness, in which narrative is essential" (p. 73). We see our lives less as a set of propositional truths and more as a series of events. Perhaps this is why even fictional stories have such emotional effects on us as they do, for a good story may move us to tears or laughter or perhaps both, sometimes moments apart.

In addition to eliciting emotion, stories have a way of altering how we view the world and even how we view the narratives of our own lives. Of entering the world of a story, Rodden (2008) says:

We as readers enter a world that is animated by values. Whether we grant or withhold assent, whether we are 'moved' to embrace the story or not, we nevertheless confront that world's axiology when we enter it—just as surely as we do when we enter a different culture. (pp. 165-166)

The power of story to shape values is precisely why the narrative paradigm of an epic tale such as *The Lord of the Rings* is worth examining.

OF HOBBITS AND RINGS: A BRIEF PLOT DESCRIPTION

The story of *The Lord of the Rings* actually begins with a book called *The Hobbit*. In this book, we are introduced to a hobbit⁶ named Bilbo Baggins who is coerced into an adventure by the wizard, Gandalf. The two accompany a party of dwarves seeking to recover lost treasure from a deadly dragon who sleeps under a far-away mountain and on top of their dwarvish gold. Along the way, Bilbo finds a mysterious and powerful ring which is able to make him invisible whenever he slips it on.

The Lord of the Rings opens with the discovery that Bilbo's ring actually was created by the Dark Lord Sauron, who poured much of his cruel power and malice into the ring. The Dark Lord has begun to seek the ring in order to regain that power and rule over all of Middle Earth. It falls to Bilbo's nephew, Frodo Baggins, to carry the ring into enemy territory and destroy it in the heart of Mount Doom from which it was made. Among others, Frodo is accompanied by the wizard, Gandalf, and his loyal friend and servant, Sam.

STONE TROLLS AND INTERSECTING STORIES

As the title of the first book in the trilogy, *The Fellowship of the Ring*, suggests, stories beckon us into the bond of fellowship. "The narrative paradigm denies individuality and calls one into a conversation with others" (Roberts, 2004, p. 140). The quote flies in the face of the rational-world paradigm, which focuses primarily on the individual, and yet it is one of the narrative paradigm's greatest strengths. Logic thrives on the individual's ability to think through and construct arguments. Stories, however, thrive on actors who experience and create events together. Stories are communal by nature.

In recounting the story of his adventure, Bilbo tells of a nearly perilous encounter he had with three

⁶ Tolkien (1997) describes hobbits as "little people, about half our height" with "no beards" and fat stomachs who "wear no shoes because their feet grow natural leathery soles and thick warm brown hair like the stuff on their heads (which is curly)" (p. 4).

trolls. Bilbo and his dwarf friends were captured by the trolls who planned to make a good supper of them. Fortunately, Gandalf was nearby, and the wizard tricked the dim-witted trolls into arguing about the best way to cook their victims. They argued for some time – until the daylight came and turned them to stone.

Years later, when Frodo and his friends discover the stone trolls during their own adventure, they are startled until they recognize the scene. “They knew the story well. Bilbo and Frodo had told it often” (Tolkien, 1994, p. 200). Upon realizing that they are witnessing a bit of Bilbo’s story frozen in time, Frodo laughs at their mistake, “Well! We are forgetting our family history!” (Tolkien, 1994, p. 200). Stumbling upon the trolls, the hobbits also stumbled upon the truth that our own stories often intersect with the stories of others.

“No man is an island,” the poet John Donne famously penned (as cited in Merton, 1983, p. xxiii). We are all living in stories that interconnect, overlap, cross, and even run parallel at times. We are not the only ones to have come this way. Others have been where we are, even if we are only as aware of it as Frodo and his fellowship. *The Lord of the Rings* reminds us that we do not live our stories in isolation, but are interconnected with the stories of others.

The interconnectedness of our stories creates the need for positive interpersonal communication. When we understand our lives as stories, we begin to discover the need for community because stories are communal. The community that is essential to our story will develop and strengthen as we learn to positively communicate within that community. To communicate positively is to better our own stories as we better the stories of others.

A counterexample will elucidate the importance of the interconnectedness aspect of *The Lord of the Rings*’ narrative paradigm. Suppose there is one who views his/her life completely from the rational-world paradigm. The *story* of this person, though he/she would not refer to life as such, would be framed by individualism. Positive interpersonal communication, for this person,

would be defined as interpersonal communication that benefits him/herself irrespective of the effect upon others. Communication with members of the surrounding community would be viewed as a means to some personalized end. Contrarily, *The Lord of the Rings* provides a paradigm for understanding our stories that fosters genuinely positive interpersonal communication by framing our stories as interconnected with the stories of others.

CONTINUING THE STORY

Bilbo explains in *The Lord of the Rings* that *The Hobbit* is actually a memoir written by Bilbo himself.⁷ He began to chronicle his adventures with Gandalf and the dwarves some time after he had returned safely to his hobbit-home, and when *The Lord of the Rings* opens, the book is still a work in progress. Before Frodo embarks on his adventure, Bilbo leaves his home for the elven city of Rivendell in hopes of putting the finishing touches to his work. In the serenity of Rivendell, Bilbo believes that he will find a proper ending for his story. Bilbo is looking for closure.

The need for closure is not surprising; every story aches for it. Narrative theorist Peter Brooks (1984) explains that “narrative desire is ultimately, inexorably, desire *for* the end” (p. 52). Closure gives meaning to all that has come before it. Bilbo is searching for this meaning, but it eludes him. When Frodo and his company show up at Rivendell after having been pursued and attacked by Sauron’s minions, he knows that his tale will not be wrapped up as neatly as he had hoped – not yet. He complains:

I was very comfortable here, and getting on with my book. If you want to know, I am just writing an ending for it. I had thought of putting: *and he lived happily ever afterwards to the end of his days*. It is a good ending, and none the worse for having been used before.

⁷ Tolkien framed *The Hobbit* in this way to account for the closure that might have prevented him from reopening the story in *The Lord of the Rings*. This way, the closure is present in the mind of Bilbo but not the story itself.

But now I shall have to alter that. (Tolkien, 1994, p. 263)

Tolkien was convinced that "there is no true end to any fairy tale" (as cited in Bowman, 2006, p.275). Bilbo also begins to realize that stories often do not end with the full closure that they seek. Rather, he discovers that there are always those whose stories will follow ours, and so, in a sense, there is always someone to continue our stories. Bilbo asks Frodo at Rivendell, "Don't adventures ever have an end?" He then answers his own question, "I suppose not. Someone else always has to carry on the story" (Tolkien, 1994, p. 226). Bilbo realizes that his adventures will continue on in the story of his nephew, Frodo. The realization of this continuance creates a sense of endearment and shared experience between the two ring-bearers.

The continuation of our stories by those who follow us creates a framework for positive intergenerational communication, an area which often proves challenging for both the elderly and the young. Inaccurate assumptions about other generations, such as the rigidity of the elderly and the naïveté of the young, "are strongly linked to chronological age and are deeply embedded in our social collective psyches; we bring them into every interaction we have with those who are much younger or older than ourselves" (Williams & Nussbaum, 2001, p. 3). The elderly have difficulty understanding the language and culture of the younger generation, and the young have difficulty perceiving the relevance of the older generation. The language of each group can seem foreign to the other.

Yet if each generation could understand their story within a framework of narrative continuance, a starting point for more positive communication between generations would be established. Within this framework, the older generation feels less threatened by and more invested in the stories of the young. The younger generation understands their connection to the past and discovers a greater willingness to know and learn from the stories of those who have preceded them. The mutual interest and investment in the stories of the other generation creates a mutual respect that

opens possibilities for positive intergenerational communication.

The Lord of the Rings offers a narrative paradigm in which positive intergenerational communication is valued. This valuation is observed in the intergenerational relationships in the story, such as the relationship between Bilbo and Frodo. One passage from the story in which Bilbo and Frodo are briefly reunited is telling:

There they sat for some while, looking through the window at the bright stars above the steep-climbing woods, and talking softly. They spoke no more of the small news of the Shire far away, nor of the dark shadows or perils that encompassed them, but of the fair things they had seen in the world together, of the Elves, of the stars, of trees, and the gentle fall of the bright year in the woods. (Tolkien, 1994, p. 232)

This private conversation beautifully illustrates positive intergenerational communication. The relationship between Bilbo and Frodo exemplifies the quality of relationship that can exist between generations when it is founded upon the continuation of stories.

The continuation aspect of this narrative paradigm offers the elderly a needed closure and offers the young a needed context. Like Bilbo, the elder generation finds closure in the comfort that their stories will not be lost or forgotten, but will live on in the stories of the next generation. Like Frodo, the younger generation finds a context for their stories that keeps them grounded, avoiding the despair due to a detached and meaningless narrative devoid of purpose. The interdependence of these narratives encourages and even necessitates positive intergenerational communication. Many obstacles to intergenerational communication will still need to be overcome, but the narrative paradigm of *The Lord of the Rings* establishes the need for a commitment to the process.

THE LARGER STORY

Although the nature of narrative demands closure, "our most sophisticated literature understands ending to be artificial, arbitrary, minor rather than major chords, casual and textual rather than cosmic and definitive" (Brooks, 1984, p. 314). While Brooks (1984) is speaking here of what Tolkien referred to as the Secondary World, we find this to be true of the Primary World as well. "Narrativeness is eternally present in the world and so a truly realist work must never have a point at which narrativeness ceases: there can be no denouement, no closure" (Morson, 2003, p. 71). A story that demonstrates fidelity to real world must always leave room for the question: what happened next? Believable stories must maintain the dialectical tension between the demand for closure and the artificiality of closure.

The preceding element leads to the most significant point of this paradigm. If our stories beg for closure and yet are seldom fully satisfied in this longing, perhaps it points to the existence of a larger Story⁸ that includes each of our individual stories. Frodo's companion, Sam, seems to intuit this as they consider the stories of old and the turns their own stories had taken:

And why, sir, I never thought of that before! We've got—you've got some of the light of [the Silmaril of Eärendil] in that star-glass that the Lady gave you! Why, to think of it, we're in the same tale still! It's going on. (Tolkien, 1994, pp. 696-697)

Sam's narrative epiphany clearly illustrates the concept of a single larger Story that encompasses his story, the ancient stories, and presumably the stories of those to come.

The idea of a larger Story appears other places in *The Lord of the Rings*. When Bilbo realized the trouble his ring has caused, he felt responsible: "Bilbo the silly hobbit started this affair, and Bilbo

had better finish it." Gandalf wisely reminded him, "You know well enough now that *starting* is too great a claim for any" (Tolkien, 1994, p. 263). The implication is that the Story was being told before we entered it, and it will continue to be told once we are gone. Gandalf might also have said that *finishing* is too great a claim for any. Before Frodo sails away in the close of the last chapter, leaving Sam and his hometown forever, he comforts Sam by telling him that he will be "as happy as anyone can be, as long as your part of the Story goes on" (Tolkien, 1994, p. 1006). Frodo believes that the Story will outlast them all.

If there exists, as Sam and Frodo suspect, an all-encompassing Story, then it should be expected to contain many different *kinds* of stories. A Story of this nature necessarily includes the stories of every race, religion, and culture. Diversity of culture is exactly what we find in the Story of *The Lord of the Rings*. The fellowship which accompanies Frodo on his quest to destroy the Dark Lord's ring consists of five different races, each with their own distinct culture: hobbits, wizards, men, elves, and dwarves. Cultural differences proved to be just as problematic in Tolkien's fictional world as they do in ours. The dwarves and elves harbored a deep mistrust for one another and an antagonism that could only be undone by participating together in a common Story.

The Lord of the Rings provides a framework in which positive intercultural communication develops as the result of a shared Story that is completed by the narrative contributions of every culture. The commonality procured from this shared Story is fundamental to intercultural communication. Communication scholar L.E. Sarbaugh (1979) describes the relationship between communication and culture: "Running through both concepts – culture and communication – is some notion of *commonality*. The word *communicate* derives from the Latin *communis* (common). From this we take the position that the communicative act involves achieving some commonness" (p. 2). The problem of intercultural communication is a lack of commonality; however, the commonality afforded by a larger common Story is enough to allow the

⁸ I use *Story* (capital S) to refer to this larger Story that encompasses the stories (lower-case s) of single individuals or cultures.

communication process to commence among even the most polarized of cultures.

The realization that all of our cultural stories are really part of a single larger Story opens us up to the importance of interacting with cultures other than our own. Cultures do not need to assimilate other cultures in order to thrive; nor do they need to be assimilated themselves. The Story becomes better not in spite of the many cultures, but because of them. A larger Story dismisses ethnocentrism because it accentuates the notion that no particular culture can tell the whole Story by itself. As Frodo's fellowship learns, dwarves and elves have a role in the telling and each will better understand their own part by listening to the other. As with intergenerational communication, the larger Story does not eliminate the complex nature of communicating across cultural contexts. *Finishing*, or perfecting communication, may yet be too great a claim for any. *The Lord of the Rings* does, however, does provide us with a positive framework for *starting*.

CONCLUSION

Fisher's assertion that we are story-telling creatures explains the role of narrative in human communication. As Rodden (2008) suggests, our lives are also lived as stories. *The Lord of the Rings* provides a paradigm for understanding those stories. This paradigm contributes to positive interpersonal, intergenerational, and intercultural communication.

The narrative paradigm of *The Lord of the Rings* and its contribution to positive communication can be summarized as follows: 1) Our stories intersect with the stories of others. This intersecting of stories creates a framework for positive interpersonal communication because it fosters a need for community. The positive interpersonal communication is defined by a desire to better the stories of each party involved in the communication process. 2) We continue the stories of those who came before us. This continuance creates a framework for positive intergenerational communication because it reveals an interdependence between generations. This positive intergenerational communication is evidenced by a strong relational bond between generations that provides closure and context to stories. 3) All of our stories are part of a larger Story. This all-encompassing Story creates a framework for positive intercultural communication because it presupposes the notion of many types of stories that contribute to the whole. This positive intercultural communication is affirmed by the replacement of ethnocentrism with the willingness to listen to the stories of other cultures. The narrative paradigm of *The Lord of the Rings* does not eliminate the complexity of these areas of communication; the paradigm simply provides a positive framework from which to approach these areas.

Key Event in Story	Aspect of Paradigm	Application to Communication
Frodo encounters Bilbo's stone trolls	Our stories intersect with the stories of others	Creates a framework for positive interpersonal communication
Frodo continues the adventure of Bilbo	We continue the stories of those before us	Creates a framework for positive intergenerational communication
Sam's narrative epiphany	All of our stories are part of a larger Story	Creates a framework for positive intercultural communication

The fictional paradigms of this story and others like it are worth studying because of the way "the plots of novels and the 'storied lives' of fictional characters influence our lives" (Rodden, 2008, p. 149). Rodden (2008) concludes: "We have much to learn from closer study of literary narratives" (p. 149). Whether or not we accept this paradigm depends on the level of narrative coherence and fidelity that we ascribe to the story. However, those for whom the *The Lord of the Rings* holds together and rings true will find in its pages a paradigm for telling a better story.

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For Self or Not For Self: The Victorian Dilemma

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ABSTRACT

Industrialization, imperialism and the concept of evolution in Victorian society caused self-doubt and self-conscious speculation amongst the English people. These themes can be seen in Victorian Literature. My paper connects Thomas Carlyle's ideal of self-consciousness as a means to man's greater good in *Sartor Resartus* with the same ideal in Jonathan Stuart Mill's *Autobiography* and Robert Browning's "A Toccata of Galuppi's" and "Abt Vogler."

The Victorian Age was marked by great changes in England. The influences of industrialization, imperialism and the evolutionary theory affected all classes of people. The country was moving away from aristocratic empowerment towards more equal rights for the lower classes as well as towards class mobility. These larger changes echoed in individuals wondering what their roles would be in this new society, as can be seen in the themes of self-consciousness in Victorian literature. Class mobility and industrialization provided the opportunity to advance oneself socially and monetarily, and the Victorians began to work for self-advancement, furthering personal ambitions above the common needs of British society. Thus, self-consciousness was often associated with selfishness, but some authors fought for self-speculation as a path to man's greater good. Thomas Carlyle, in *Sartor Resartus*, encourages anti-self-consciousness, and he also affected other authors to write in the same tone.

John Stuart Mill, in *Autobiography*, and Robert Browning, in "A Toccata of Galuppi's" and "Abt Vogler," follow the theme set up by Carlyle in *Sartor*. Instead of advancing individual gains, they establish that the greater good for the individual is the common good of all mankind, and to work towards this good is every man's role. Mill follows this example to a tee, while Browning focuses on how the inward stages of consciousness (set up as three stages in *Sartor*) affect the individual removed from the whole picture of the progressive stages.

Carlyle believed that in the transforming Victorian society, the individual needed to work for the common good of all man, not just for individual profit. He "found that certain things could only be said through indirection and could best be expressed, therefore, through fiction" (Levine 132). In *Sartor Resartus* he uses a fictional protagonist to express his beliefs without directly attacking Victorian society. This way, he can still express his disapproval of Victorian society that seeks selfish gain instead of the best good for mankind. Unlike Mill, whom he influenced in *Autobiography*, he does not state that this common good is what is best for the greatest majority. Instead, through his fictional protagonist Professor Teufelsdröckh and the three stages he goes through ("The Everlasting No," "The Centre of Indifference" and "The Everlasting Yea"), Carlyle shows that each man has a duty to society to improve it. But in the face of a changing England (or in Teufelsdröckh's fictional case, perhaps a changing Germany or, more vaguely, the world) that duty must be redefined. In "The Everlasting

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No," Teufelsdröckh's spiritual progression introduces his doubt. Though progress is inevitably good, Carlyle states, "Such transitions are ever full of pain" (*Sartor* 1006), and the pain of England's progress was the doubt it bred; Carlyle focuses on religious doubt as it applies to man's duty. "The infinite nature of Duty" does not escape Teufelsdröckh despite his uncertainty about God's existence. Even though he is "living without God in the world, of God's light [he is] not utterly bereft" (1008). Even as he doubts, his self-consciousness keeps the fact that he has a duty ever-present.

At this point, Teufelsdröckh is questioning his duty, as "it is but the common lot in this era" (1008) to doubt. Fear is holding him back from action. By the end of the first section, Teufelsdröckh's self-doubt has caused him to realize that a new definition of duty is necessary, but he has not acted upon this knowledge. The "Centre of Indifference" begins with Teufelsdröckh's attempts to conquer the doubt, not with indifference, but with imperialism and industrialism (on an individual level). His attempt does not alleviate his unrest. At first he storms through the world like an imperialist, conquering dominions. This does not quench his thirst, just as it did not quench Alexander's thirst (he wept "because he had not two Planets to conquer" [1017]). Neither will English imperialism bring an answer to Victorian doubt. This attempt is also marked by wars that Teufelsdröckh witnesses, where Victorians can see that industrialism is not the answer either:

How has thy breast, fair Plain, been
defaced and defiled! The
greensward is torn-up and
trampled-down; man's fond care of
it, his fruit-trees, hedge-rows, and
pleasant dwellings, blown away with
gunpowder; and the kind seedfield
lies a desolate, hideous Place of
Skulls. (1013)

Once he has seen that industrialism and imperialism do not work, Teufelsdröckh really enters his period of indifference, noted by his being referred to as an ideologist. He compares his

status with that of an ideopraxist; while the latter puts ideas into practice, Teufelsdröckh merely thinks that he has a duty to perform without doing it.

Of course, he has still found nothing to replace his doubt. This relates to Mill's indifference, when he realizes what will bring happiness, but has not experienced a catalyst to push him towards action. Teufelsdröckh's catalyst is a sort of "glorious revolution" (1018) in "The Everlasting Yea." He returns to self-consciousness. In this state he experiences "a healing sleep" (1019) from God (the upper Influence). After this sleep, Teufelsdröckh comes to the same conclusion that Mill comes to: "In every new era, too, such Solution comes-out in different terms; and ever the Solution of the last era has become obsolete, and is found unserviceable" (1021). This statement reinforces his search for a new meaning of duty, even as it applies to others besides himself. In "The Diamond Necklace and the Golden Ring: Historical Imagination in Carlyle and Browning," Lee Baker quotes Carlyle: "The past belongs to...the Death Goddess...overspread with pale horror, with dim brown oblivion" (Baker 32). Carlyle goes on with his grim view of the past with a description of historians as undecipherable, formless men. Baker states that Carlyle's view of the past is due to the historian's distance from the historical events. They cannot "recreate [the life of the past] in an adequate form" (33), so past reactions to problems are somewhat obsolete.

However, the past still holds examples to guide the Victorians through their present transformations. At the top of the list is the example set forth by Jesus Christ. After using this example of a man who lived to serve others, Teufelsdröckh is able to introduce the higher happiness – the common good of all mankind – as a blessedness that can be achieved through the annihilation of self. He also presents an example that involves an individual giving a portion of his happiness to another; this generosity can be seen as a type of "Renunciation" (*Sartor* 1021) of self. Victorians should follow this example and let go of selfishness; blessedness will replace it.

But more than blessedness is necessary to get rid of doubt. The achievement of blessedness through self-annihilation is but the passive, almost indifferent, part of man's duty. To overcome doubt through action, one must "[d]o the Duty which lies nearest thee" (1023). This call to go out and "Produce!" (1024) is more vague than Mill's call to action, because it comes without an example of Teufelsdröckh's duty to the Victorian community. Yet it does not lose its impact, because Carlyle uses Teufelsdröckh's last words to call the masses to action. The individual's role is to perform a duty to bless his fellow man, not force other nations into English views of thinking through imperialism or pushing people into foreign cities through industrialization. By performing their duties to man, the Victorians can overcome their doubt in the same way that Teufelsdröckh overcame his.

John Stuart Mill works his way through the same self-conscious doubt in *Autobiography*. He is able to use personal experience where Carlyle created a fictional character. Mill goes through three stages, similar to Teufelsdröckh's stages, to reach his enlightenment: "[He] journeys from a dark wood of unfeeling rationalism, through a purgatory of mental crisis and enlightenment, and finally into a realm of philosophic thought and action" (August 143). Chapter 5 of *Autobiography* opens with Mill's feeling of self-doubt during "the general improvement going on in the world" (Mill 1071). This correlates to the general feeling of doubt of the time due to new theories and discoveries in creation and geology. The Victorians shared Mill's "irrepressible self-consciousness" (1071) as their world was rapidly transforming. Like Mill, they wondered what the changes would do and how they could be put to good use. This doubt in Mill helps him realize that the completion of all his goals will not bring happiness, as English progress will not bring happiness to the nation. Thus, his object in life – to reform the world – comes under scrutiny and he begins to feel insipid and indifferent. He has nothing within him, like Carlyle's Teufelsdröckh in his "Centre of Indifference." English imperialism also sought to reform the world on a larger scale, but both personal and global reformations are not completely attainable. Victorians as a whole feel

the doubt of imperialistic progression, but are as indifferent as Mill is. But this indifference towards his pleasures creates a "conviction of sin" (1071). He comes to the conclusion through his self-conscious analysis that "the pleasure of sympathy with human beings, and the feelings which made the good of others, and especially of mankind on a large scale, the object of existence, were the greatest and surest sources of happiness" (1073). He suggests that England should likewise take their doubt and self-consciousness and turn it towards the good of mankind, not only the reformation of the world according to English standards.

During this introspective time, Mill looks within himself and realizes that the past holds no answers to the present's problems. He must find a new way to approach the solution to his doubt. Not only does he find no help from "memorials of past nobleness and greatness" (1071), but his own father's plans fail him as well. He is conscious that society needs new means to accomplish good for all mankind and implies that the Victorians should become self-conscious not for selfish means but for the betterment of mankind.

Yet Mill was still in his center of indifference. "[T]here seemed no power in nature sufficient to begin the formation of my character anew" (1073) until he realizes how much he has in common with Carlyle's anti-self-consciousness. Carlyle reinforces his belief that "those only are happy...who have their minds fixed...on the improvement of mankind" (1074). He begins to see that not only self-conscious speculation but also action is required and hopes to relay this message to the Victorian masses.

Mill finds that his action for the greater good of all is centered on art: "I now began to find meaning in the things which I had read or heard about the importance of poetry and art as instruments of human culture" (1075). The importance of art gives him a vessel through which to act. He does not tell the Victorians what their actions should be to combat their doubt, but he does set up one main guideline. All men have feelings in common; so all men should be interested "in the common feelings

and common destiny of human beings" (1077). The good of all mankind, in Mill's opinion, is what is best "for the great majority of mankind" (1075) or for what benefits common feelings. The individual achieves this common good through action. Mill's autobiographical example to the Victorians is his action through the arts as a writer, but, beyond the example, Mill does not specify what kind of action each individual must perform. In his life, self-consciousness followed by action helps him escape his doubt of his place in the changing world.

Mill and Carlyle had slightly different definitions of the good of all man. In the face of doubt that imperialism, industrialism and evolution produced, they took a journey from self-consciousness to action. They set up guidelines to help the Victorians achieve the good of all man, which would have in turn benefited the individuals who worked towards it.

Browning does not follow this path to action seen in Carlyle and Mill. In "A Toccata of Galuppi's," he gives readers the self-conscious musings of the scientist in his "Everlasting No" phase. Another of his musically based poems, "Abt Vogler," shows the narrator in "The Everlasting Yea" stage, free from the doubt of the Victorian Age. Browning's use of music to show his narrators in two stages similar to Teufelsdröckh's phases shows Carlyle's strong influence on him. Carlyle believed that poetry, and poets, should be "Musical thought [:] It is only when the heart of [the Poet] is rapt into true passion of melody, and the very tones of him become musical by the greatness, depth and music of his thoughts, that we can give him right to rhyme and sing" (*Letters* 299-300 note). Browning exemplifies Carlyle's theory while also exemplifying "The Everlasting No" and "The Everlasting Yea." Mill returned to art in *Autobiography* after his doubt and indifference, but Browning uses music to achieve his self-conscious realization that he must produce for the good of man. He uses the opposing side of doubt (the doubt in the new science instead of God) to reveal the same belief that Carlyle and Mill found – that science does not overcome God.

The narrator of "Toccata" is a 19th-century English scientist, a narrator directly from the Victorian Age. This gives readers the impression that this narrator follows reason and logic over Christianity and art. He knows "physics [and] something of geology" ("Toccata" 37). At the time "Toccata" was published, *Vestiges of the Natural History of Creation* by Robert Chambers and *Principles of Geology* by Charles Lyell had been out for at least 10 years, so Browning's scientist is soundly founded in his scientific beliefs. But stanza 11 introduces the doubt he feels because of Galuppi's music. His doubt is brought on by art, rather than by science, which sets him apart from Teufelsdröckh and Mill. Yet the music makes him look inward "with such a heavy mind" (3), because it makes him unsure of his science.

The narrator's inward self-consciousness focuses on the past and what he imagines Galuppi's Venetian crowd was like. Where the past to Carlyle and Mill was an outdated example to follow for the Victorians, the past is the reason for the doubt that Browning's narrator feels. Galuppi's music is "recreating a past life" (Schweik 135). The scientist imagines frivolity in the past, which at first assures him that he is not like them. Even by stanza 13, the scientist daydreams that the music (or Galuppi) is telling him, "[Y]ou'll not die, it cannot be" ("Toccata" 39)! Galuppi's audience attends balls and masks, only breaking off the conversation to appreciate the music that makes them feel: "Brave Galuppi! That was music; good alike at grave and gay! / I can always leave off talking when I hear a master play" (26-27)! He seems to be superior to them, using his reason to give him assurance that the past is different. He does not directly state that the past as an example for the present is archaic, because as the toccata continues, he likens himself to the ancient audience through the music's effect. He portrays his emotions through theirs. The audience asks, "Must we die?" (20); the narrator wonders about this same question by the end of the toccata when the ending music reminds him that the Venetians are dead and he will die also. The aspect of his death makes him doubt his science as he considers the afterlife.

This almost complete focus on the past shows that scientists, like historians in Carlyle's mind, are undecipherable and formless. The narrator has no true experience, since he "was never out of England" (9) and can only see the Venetians "in a precariously subjective way in the highly limited, partly confused, and selectively biased imagination of a specific auditor [the scientist]" (Schweik 133). By the end of the poem, he doubts, as all other Victorians did, his beliefs. The toccata is no longer depicting life for the Venetians, but it is reminding him that he will one day be "[d]ust and ashes" ("Toccata" 35, 43) like them, despite his scientific beliefs.

This doubt, like the doubt of "The Everlasting No," is the precursor to more self-conscious thoughts that lead the protagonists and narrators on an internal journey. Browning leaves off with the scientist's doubt. Readers can only suspect whether or not he will find the greater good of man as Carlyle and Mill did in their complete journeys. But "Toccata" is not the only poem Browning gives us regarding music and the stages that lead to enlightenment. In "Abt Vogler," he gives us the opposite side to the doubt, "The Everlasting Yea," through another musician.

"The Everlasting Yea" marks Teufelsdröckh's understanding of his duty in the world, which brings him peace in the end. The musician Vogler exudes confidence and peace within himself as well. He is beyond the doubt of the time. It is important to note that Vogler is a priest, the extreme opposite of the scientist in "Toccata" that doubted religion. Vogler is firmly grounded in Christianity. His language as he reflects on the music he creates exudes confidence: his music is "fearless" and "brave" ("Vogler" 16,1). Furthermore, he is German, like Carlyle's protagonist in *Sartor Resartus*. Vogler is past the doubt represented in "Toccata." His musical thought has led him to put art over reason, like Mill: "The rest may reason and welcome: 'tis we musicians know" (88). What he knows is that God will always be the same, no matter how the times change and bring new doubt. He is ready for his action. Teufelsdröckh ended his "Everlasting Yea" with a call to "Produce" (*Sartor* 1024)! Vogler's

production is his music, which is "[e]ager to do and die" ("Vogler" 20), performing its own action ("to do"). This action, though the music will not last, leads towards the greater good of man. In stanza 10, Vogler states that the good hoped and dreamed for (kin to the good of all mankind for Carlyle and Mill) will exist. He is free of doubt in his self-consciousness, so he can continue to play his music – perform his action for good.

The jump between the two poems does not show the coherent linear train of thought that Carlyle and Mill followed, but they are glimpses of the beginning doubt and final realization of duty in the time of doubt. Browning's poems include the thought processes that show Carlyle's stages and many of the same devices he used in *Sartor*.

Carlyle's influence is obvious in Mill and Browning, two close friends of his. *Sartor Resartus* was the precursor to their self-conscious literature, though they each found different ways to express it. Carlyle was "concerned exclusively with subjective states" (Levine 133) in his protagonist, while Mill focused on personal experience and inward thought and Browning used different narrators to express their feelings through music. Carlyle and Mill agreed that the Victorians should approach the changes in England by working for all men's good. In Carlyle's own words, Browning was "dreadfully difficult to understand" (*Letters* 298), so what we get from Browning is more obscure. He states that self-conscious musings show that evolution and scientific reason will not bring the progress the Victorians seek. But through Browning's use of music and Mill's autobiography following the pattern of *Sartor Resartus*, Carlyle's influence in the self-conscious realm of thought is apparent.

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Forensic Analysis of iPod Touch Generation 2

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ABSTRACT

The digital forensic science for Apple iPods face the challenge of keeping pace with the fast progress of technology. While the popularity and widespread use of Apple iPod have increased the possibility of its being used in crime, sound and legally acceptable procedures of forensic investigation are yet to be developed. Apple iPod Touch devices, launched for the first time in 2007 are significantly different than older iPods in many ways. We investigated the Apple iPod Touch generation 2 from a digital forensic perspective. In this paper, we describe our investigation techniques and findings.

INTRODUCTION

With about 20 million units sold during fiscal 2011 first quarter [1], the Apple iPod has become one of the most widely used digital devices in recent times. Initially created for storing and playing music files, it has transformed to be a multipurpose storage device, capable of storing different types of files and also capable of connecting to the Internet. Clearly, this tiny handheld device is now being used as an alternative to personal computers or laptops. Although iPod was initially designed as a device for entertainment, its improved storage capacity, and its Internet connection facility along with its portability have made it eligible for malicious usage as well. Furthermore, being a primary medium of entertainment, iPod is less likely to draw attention as a potential storage of illegal activity related data.

An iPod can be used for illegal activity in many different ways. Most commonly, it can be used to store crime related data [2, 3]. A tech-savvy criminal may find ways to hide incriminating

information by directly accessing iPod's file system. Modern iPods being capable of connecting to the Internet, online illegal activity may be performed with it. Even if an iPod is not directly associated with a crime, a lot of personal information regarding a suspect or a victim can be obtained from the calendar, contacts and image files stored in a modern iPod. Clearly, it is important to gain understanding of the internal design of iPod or similar devices from a forensic point of view and find out efficient ways of extracting information from such devices.

Some research work has been done on the forensics of a traditional iPod [6, 7, 8]. However, the biggest challenge is to keep pace with the ever-changing technology of Apple. Recently Apple has launched the iPod Touch – a new model that closely resembles Apple's iPhone visually and functionally, and therefore is significantly different from its older counterparts. One major difference is that it can be connected to the Internet. This magnifies the potential of this device to be evidence in different types of crimes to a great extent. This model of iPod has been so popular that over 45 million units were sold within 2 years of launching [1].

In this paper we describe our research on an iPod Touch generation 2 device with the most updated set of software and the Apple OS. The main objective of our research was to determine the ways of using this device in various crimes and forensically sound ways of extracting evidence from it. An iPod Touch, unlike older iPods, cannot be used in disk mode unless it is "jailbroken". And powerful software such as EnCase or AccessData FTK cannot be used to investigate iPod Touch unless it is jailbroken. This is because without jailbreaking an iPod Touch, the Digital Rights Management protection remains, so you cannot read or write files on the iPod itself, so you cannot

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explore the disk with forensic software nor make a bit by bit copy to inspect with the software after. We found out that jailbreaking can wipe out evidence from an iPod Touch if used with the wrong firmware. Thus, jailbreaking is not a forensically sound procedure. And therefore, a jailbroken iPod Touch may not be acceptable evidence in court.

The next section of this paper focuses on the existing research on iPod forensics. In Section 3, we describe our experimentation procedure and results. Section 4 contains our analysis from digital forensic point of view. Section 5 concludes this paper.

PREVIOUS WORK

Research on iPod forensics is a fairly new field. A technical report published by CERIAS (Center of Education and Research in Information Assurance and Security) at Purdue University in 2005 describes how forensic data acquisition can be accomplished from a regular iPod device [6, 8]. While this study was performed in details, the iPod used in this experiment was only a music storage device. When newer generation iPods came into the marketplace with different technology, Masico and Rogers came up with some changes in evidence acquisition and analysis procedures [7]. The iPod devices used for these experiments are significantly different than the iPod Touch device analyzed in our project.

FORENSICS OF IPOD TOUCH

The main usage of iPod is to store, retrieve and transfer audio, video or image files only. Older generation iPods (that are non-Touches) have a feature called "disk mode" that allows transferring any type of files including text files when using Windows Explorer in a Windows computer. When connected to a computer, iPod acts as an external hard drive and performs in disk mode. But iPod cannot display on its screen the files transferred through Windows Explorer directly [7], unless it is a file that can be used on the old iPod generation OS (such as text files, contacts, and pictures). Only the data created by user interaction through

iTunes can be seen on the integrated screen of the device (on the iPod Touch and iPhone). The other non-iTunes files can be discovered only through a physical analysis. This increases the potential of an iPod to be used in crime to a great extent. Not only evidence of crime can be hidden in an iPod, but also there can be malicious programs capable of destroying iPods utilizing this feature.

New generation iPod Touch devices can be used in disk mode only via a process called "jailbreak". This process opens the iPod Touch OS software in order to install non-Apple-approved software. Jailbreaking allows user greater access to the system and enables the user to do things not approved by Apple (such as, before the feature was available in iTunes, create ringtones). However, jail-breaking also increases the risk of installing malicious code and data corruption.

The ability to connect to the Internet increases the potential of an iPod Touch to be used in a crime. The iPod Touch has a way to connect to a WiFi signal just like a laptop. A list of connectable WiFi hotspots is shown on the screen. Any open or unsecured signal can be picked up by the iPod. Downloading and uploading are possible using the Internet. A jailbroken iPod has more potential for a direct crime than an iPod in a default mode (non-disk mode). A jailbroken iPod Touch can make a secure socket via the internet with a computer (a basic socket with a listener interface for a specified port). This allows file transfer via the Internet. Also when the OS is broken open the iPod Touch can function like a laptop, with the possibility of having scripts being run on it which could target a system on its same WiFi hotspot/network with a computer crime. Needless to say, a small portable device with Internet connectivity can be a very useful tool for computer crime. Also, unlike an iPhone, an iPod cannot be traced to a certain name as an iPod is not associated with a particular account.

Clearly, there must be forensically sound ways of extracting information from an iPod Touch and analyzing that information. Our research involves the physical analysis of generation 2 iPod Touch with newest OS and newest version of iTunes. The

main objectives of our experiment are stated below:

- To discover the capabilities of the new iPod touch and iPhone devices and platforms in correlation with forensic investigation
- See how the new Apple products relate to their older counterparts as tools used in computer crime
- What to do as a forensic investigator with these new devices and how to go about investigating them
- Try to put possible evidence on an iPod touch like a criminal would and investigate the iPod like I would a forensic investigator.

DESCRIPTION OF IPOD TOUCH

The iPod Touch, available with 8GB, 16 GB or 32 GB storage space, is a portable media player as well as a personal digital assistant with Wi-Fi mobile platform. Launched in September 2007, it is the first iPod with wireless access to the iTunes Store and Apple's App Store, enabling content to be purchased and downloaded directly on the device. The iPod Touch resembles the iPhone (a smart phone by Apple) physically and uses the same hardware platform and operating system. However, the iPod Touch lacks some of the features of iPhone such as GPS and calling capabilities. The iPod Touch used for our research is generation 2. This generation 2 iPod has Bluetooth functionality. As the platform of research, we used the most updated version of iTunes (v10.1.2.17) and the iPod touch OS (v4.2.1).

PROCEDURE

As stated before, our main objective was to determine how to extract evidence from the iPod. Our experiment had three main steps: iPod setup, forensic image acquisition and forensic analysis.

iPod Setup. The first step of our experiment was to store different types of files in the iPod Touch. Data was entered in iPod Touch both in default mode and disk mode.

Default mode data entry: We kept the iPod in "stock" mode or default mode (i.e., with limited access imposed by Apple) and performed three steps. First, we placed information on the iPod touch with iTunes by connecting it using its USB cord and using the iTunes interface to sync it and send files using the iTunes library (things have to be in the library in order to sync by adding it to iTunes via the Add... dialog box). These files included music, movies, podcasts, pictures, calendar entries, notes/texts files, etc. We entered information in calendar entries, contact entries and notes. We also created regular text files and saved it in iPod. Second, we surfed websites using a WiFi connection to create Internet traffic and downloaded files like documents, pictures, emails, etc. And finally, since there was no way to put hidden files on the iPod touch via iTunes, we used the program DiskAid to store hidden files [4]. The iPod Touch is read-write protected to prevent music and program piracy. DiskAid is a simple application that enables us to look anywhere in the iPod touch file system and insert and view all files including hidden ones. Even iPod Touch's system files are viewable through DiskAid.

Disk mode data entry: We enabled "disk mode" in the device. In order enable a "disk mode" like previous iPod generations (where you can drag/drop files freely to the iPod), we needed to "jailbreak" the iPod touch. Jail-breaking, as stated in the previous section is a new feature of iPod Touch that can affect data storage in the device in many ways. We installed a jailbreaking program Redsn0w [8, 9] on a Windows computer and then used a downloaded iOS backup to submit to the Redsn0w program where it changed the iOS on a bit level. From there the modified or "jailbroken" iOS was installed on the iPod touch. Jailbreaking allowed us to do the following:

- Use iPod Touch as an external disk to a computer
- Access the root directory and the file system
- Open a secure socket via an internet connection to edit/remove/send files through the Internet

Forensic image acquisition. At present, there are several ways of extracting data from an iPod Touch. For example, iTunes Sync can be viewed on a computer. This does not allow us to recover deleted files or view hidden files. Another problem with this method is that it is not possible to get data out of the iPod unless the host system is located. Syncing an iPod to a computer other than the host computer will wipe off the existing data due to the Digital Right Management feature (DRM). Therefore, in order to extract information from iPod via iTunes Syncing, the suspect's computer is also needed. Another way to extract data would be jail-breaking the iPod Touch. Jail-breaking an iPod enables users to install non-Apple tools. Open-source UNIX tools can be installed to extract a bit-by-bit logical image of the data partition. This can be done remotely over a Wi-Fi connection. However this method is not very forensically sound as it involves altering firmware and hence may not be acceptable evidence in court. Alternatively, disassembly or the use of forensic software could be utilized. Disassembly requires getting Read-Only-Memory (ROM) chips out of the iPod and extracting data with a NAND dump. This method is complex and was not tried in this research. Forensic software such as AccessData FTK(1.81) and EnCase (v6.18) allow extracting a forensic image of the iPod disk drive. We obtained a live image of the iPod storage medium in raw (.dd) format using both EnCase and AccessData FTK.

Forensic analysis. We performed static analysis using both EnCase and AccessData FTK. All files were successfully found including the hidden ones. We also performed live analysis using EnCase.

Observations and analysis: In both static and live analysis, we recovered all files including hidden files that were in the iPod Touch. In addition to finding files, we found some associated information that can be extremely useful for investigation.

First, the name of the computer that first initialized the iPod can be found. The iPod touch, when first synced or restored, is given a sync "home". This means that the iPod Touch keeps a

record of the computer name it is first initialized with. During the first initialization, a folder is created and saved in the iPod disk that contains all back up data regarding the iPod and the name of the host computer. With this information, investigators can prove which computer was the first host computer. This information is located in the iPod Touch's "System" folder which you are normally unable to explore or see without jailbreaking it.

Next, hidden and modified files can be found with tools such as DiskAid without jailbreaking. The iPod Touch has read/write protection for security reasons. When it is in default mode, it is allowed to transfer files only through an iTunes interaction. This is a limitation for both criminals and investigators. However, a tool used to put on hidden files or to edit files can be used to investigate the same hidden and edited files. DiskAid is such a tool. Using DiskAid, it is possible to find all the same files as with the forensic tools, but you are manipulating the files directly on the iPod disk (such as access times). However, this is not forensically sound like forensic software would be.

Jailbreaking allows the investigator to use powerful forensic tools such as EnCase. If the iPod is jailbroken, it can be used as an external hard drive or as a thumb drive. Thus, forensic tools such as EnCase can be used to extract and analyze any type of information. Jailbreaking iPod Touch is a very straightforward procedure, as was stated above.

However, jailbreaking is not forensically sound. While jailbreaking has been made legal by the US Copyright Office, the legality of jailbreaking from a digital forensic aspect can be questionable. Although jailbreaking the iPod Touch does not erase the file contents that were put in the device during default mode, the device can be wiped off if the correct firmware is not used. Even with proper firmware the disk of the iPod can be modified. Therefore, a jailbroken iPod Touch may not be legally acceptable as evidence. The ideal way is to remove the hard drive from the iPod Touch and directly image it with write-protection.

So far, there has been no technology that can allow such procedure.

Analysis techniques of the FAT32 file system are applicable to iPod Touch. The iPod Touch generation 2 uses a FAT32 file system on the Windows version. Therefore, analysis procedures for FAT32 file systems in a computer can be used with iPod Touch as well. The Mac versions of the iPod Touch and iPhone use a HFS+ file system. Therefore, investigation techniques for these devices are different. We did not experiment with MAC iPod Touch.

There are similarities between iPod Touch and iPhone: all techniques used in this investigation are theoretically directly applicable to the iPhone as well (but research efforts related to this study were not able to completely verify this). The generations of the iPod touch and iPhone are constantly on par and contain the same components, aside from the radio transmitter in the iPhone (which allows its phone and 3G/4G capabilities).

CONCLUSION

The popularity and widespread use of Apple iPod have increased the possibility of its being used in crime. However, Apple iPod being a fairly new device, sound and legally acceptable procedures of forensic investigation are yet to be developed and little research has been done on such procedures. Apple iPod Touch device is significantly different than older iPods in many ways. In this paper, we describe our investigation techniques and findings of iPod Touch generation 2 device. We found out that forensic image acquisition and detailed forensic investigation can be done on iPod Touch only in "jailbreaking" mode. However, jailbreaking is not a forensically sound procedure as it can modify the device. We are currently working on finding a forensically sound procedure for image acquisition of an iPod Touch hard drive.

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Opportunities for Undergraduate Research

Social Research Center

Students at Columbus State University have an excellent opportunity to engage in research collaborations with The Social Research Center. The center is located in Arnold Hall 210 and provides research assistance to students, faculty, and community partners. The Social Research Center promotes partnerships that include student projects, faculty supervised research, and applied research opportunities with community organizations. This short outline of the Social Research Center focuses on a few unique aspects of the office including applied student research, development of research skills, and networking across departments.

Applied Student Research

Students seeking *assistance* with projects for presentation at a conference or development of a peer-reviewed article should stop by the Social Research Center. The staff at the Social Research Center is willing to help students develop their research project and locate faculty members with a shared interest to gain advice or assistance. There are also opportunities for students to work on faculty led projects in which students play a meaningful role while receiving mentoring related to the research process. This provides an excellent opportunity to gain valuable experience that can be applied for professional employment or graduate study. In addition, the faculty and staff working on collaborative partnerships with students through the Social Research Center have agreed to assist students with the development of a student project that parallels the existing research. These range from student presentations at conferences, development of a colloquium presentation, or submission of a paper to a peer-reviewed journal.

Development of Research Skills

Development of student research skills is a key part of the Social Research Center's mission. This includes hosting academic courses in the Social Research Center's computer lab in Arnold Hall 204. The staff of the Social Research Center makes special visits to classes upon request to talk about a research related topics. The Social Research Center also promotes University and College activities related to research to provide additional training venues.

Students also have opportunities beyond classroom exercises or training seminars. Columbus State students receive hands-on experience working directly with faculty research projects and collaborating with faculty on services for community partners. All Social Research Center projects that have direct student involvement include the goal of a completed student project. These include research presentations or completed research reports for community organizations.

Networking

The Social Research Center staff can also assist students in locating resources for research. These resources include funding opportunities, research internships, fellowships, and assistance locating potential student or faculty collaborators. This is particularly important for students who are interested in pursuing interdisciplinary projects that require expertise from departments that are unfamiliar.

Student Research is at the core of the Social Research Center's mission. New research opportunities and programs routinely become available. If you would like more information about the Social Research Center please find look online at <http://research.columbusstate.edu/src/> or you may contact the Director, Dr. Kyle Christensen at (706) 565-3526 or by email christensen_kyle@columbusstate.edu

Submission Guidelines

Momentum is an undergraduate, refereed research journal open to all disciplines that will be disseminated to undergraduates, faculty, and the CSU academic community. Successful papers will appeal to a wide audience and should clearly define technical language that may be discipline specific. Please submit original work that is considered scholarship within your discipline. Scholarship may include, but is not limited to research studies, literary analyses, or artistic critique.

Any creative writing (poetry, short stories, etc.), creative non-fiction pieces, or artistic endeavors will be referred to Arden, the CSU literary journal, unless the submission is pertaining to comparative analysis, criticisms, and interpretations of a literary work.

Electronic Submissions

Articles should be submitted via email to honors@columbusstate.edu as a Microsoft Word document with a *.doc suffix. Submissions should include a cover sheet, an information sheet (cut and paste from below), and the main body of the work.

Main Body

Length of the main body should be appropriate to the discipline but may not exceed 5,000 words (excluding references). Font should be Times New Roman, 12 point, and double-spaced. Each page of the body should contain a header with an abbreviated title, the discipline that the work was submitted under, and page number. Headers may appear on all submitted pages or may begin just with the main body.

Cover Sheet

The coversheet should be prepared in the order listed below. All authors and faculty members who contributed to or assisted with the research project must be provided, but should be on the coversheet only so that they may be easily removed for the blind selection process. Abstracts should be between 200 and 300 words and should be single-spaced. Any submissions that do not meet these guidelines will not be accepted. If you have any questions about length or general requirements, send an email to honors@columbusstate.edu.



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